Design of Internal Mechanism for Adjustable Computer Mouse operated using Single Control Input

A thesis submitted in partial fulfillment of the

Requirements for the degree of

Bachelor of Technology

In

Industrial Design

By

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Declaration

I hereby declare that this thesis is the outcome of my own work and effort. Throughout this documentation wherever contributions of others are involved, every endeavour was made to acknowledge this clearly with due reference to literature. This work is being submitted for meeting the partial fulfilment for the degree of Bachelor of Technology in Industrial Design at National Institute of Technology, Rourkela for the academic session 2011 – 2015.

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Certificate of Approval

This is to certify that the thesis entitled "**DESIGN OF INTERNAL MECHANISM FOR ADJUSTABLE COMPUTER MOUSE OPERATED USING SINGLE CONTROL INPUT**" submitted to the National Institute of Technology, Rourkela by **SOVAN SUMAN DHAL, Roll No. 111ID0270** for the award of the Degree of Bachelor of Technology in Industrial Design Engineering is a record of bonafide research work carried out by then under my supervision and guidance. The results presented in this thesis has not been, to the best of my knowledge, submitted to any other University or Institute for the award of any degree or diploma. The thesis, in my opinion, has reached the standards fulfilling the requirement for the award of the degree of Bachelor of technology in accordance with regulations of the Institute.

.....

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Date:

Acknowledgement

First and foremost I offer my sincere gratitude to my project supervisor, Dr. Mohammed Rajik Khan, Assistant Professor, Department of Industrial Design, NIT Rourkela, for his valuable guidance and endless support during the execution of this project.

I also thank all my friends and family members who helped me during the course of the project. I am highly indebted to Department of Industrial Design for providing necessary information and guidance regarding the project and also for their support in completing the project.

My special thanks to Mr. Nagmani and appreciations to all machine operators and people who have willingly helped us out with their abilities to understand various operations and machines.

Last but not the least I would like to thank National Institute of Technology Rourkela for giving us this wonderful opportunity.

Sovan Suman Dhal (111ID0270)

Abstract

The large amount of control operations provided in adjusting the shape of currently available adjustable computer mice leads to redundancy and confusion in the mind of the users as they have to adjust all dimensions separately in most cases while the fact being that an increase (or decrease) in one dimension of the human hand leads to an increase (or decrease) in all the dimensions. Hence the work has been concentrated on the development of a mechanism to be planted inside a computer mouse which can simultaneously increase or decrease all dimensions of the mouse proportionately based on a single control input. Finally an adjustable computer mouse has been designed based on the mechanism developed.

Keywords: Adjustable, Computer mouse, Single control input

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1. Introduction

Majority of the computer mice found in the market have a fixed structure w.r.t. length, width and height. But often while their span of usage, they are used by various individuals with different hand sizes. It is logical to conclude that the same computer mouse wouldn't provide equal level of comfort to all its users because its dimensions are fixed and cannot be changed. Many computer hardware companies which excel in design of computer mice have recognized this latent need of the users wanting to be able to change the physical dimensions of their computer mouse according to their needs. As a result they have designed mice with adjustable physical dimensions. But the issue with such mice that they provide too many controls for an individual to alter at a given time. And if often becomes time consuming and confusing job to adjust the mouse to one's own requirement as all the dimensions of the mouse have to be controlled separately using separate control inputs in the form of knobs, sliders etc. Hence in this project I have devised a mechanism which can be used to increase all the dimensions of a computer mouse simultaneously using only one control input. This mechanism could be further calibrated according to the hand anthropometry of human beings so as to design a computer mouse which can change its shape and size form the smallest to the largest, providing comfort to a specific hand size in a specific configuration.

1.1 Problem Statement

The adjustable computer mice available in the market provide high levels of customization but at the same time it leads high amounts of redundancy because, as per human hand anthropometry only a particular configuration of a computer mouse can provide maximum comfort and not all possible configurations are optimal. Moreover these nice provide large number of controls for its users to handle which can be can be replaced by a single control that could change all dimensions of the mouse simultaneously. So the challenge here is to device a mechanism which can be used inside a computer mouse to change all its dimensions simultaneously using only one control input.

1.2 Objective of the Work

To design acomputer mouse with the flowing characteristics.

- Adjustable length
- Adjustable width
- Adjustable Height
- Ambidextrous Design
- Single control for all adjustments
- User friendly calibration

1.3 Review of Literature

1.3.1 Angle Adjustable Computer Mouse that can be used with either hand

US 2009/0295726 A1

This invention describes a computer mouse whose top component is a pivoted half whose angle can be changed according to the preference of the user by sliding the top component over the base component. It can be used by both left and right handed users.

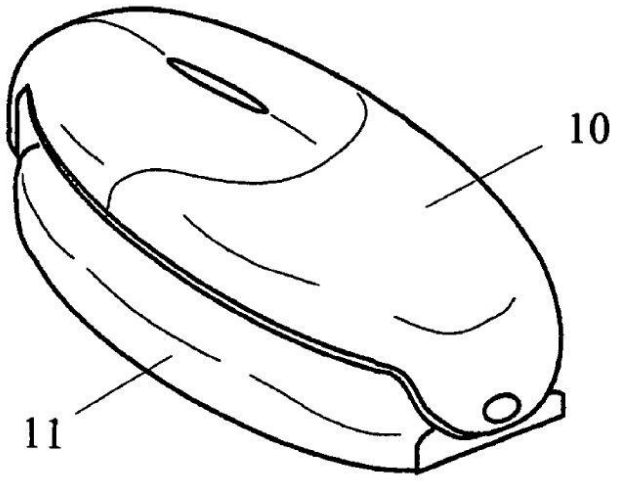

Figure 1. Angle Adjustable Ambidextrous Mouse [1]

1.3.2 Computer mouse with adjustable decorative wing: US 2014/0210718 A1

This invention show the design of a computer mouse whose sides can be expanded by the help of wings attached to a main structure. The mechanism is operated by the help of a threaded linear expansion mechanism. The wings come out on both sides enabling an ambidextrous design. There is no provision for length and height changes.

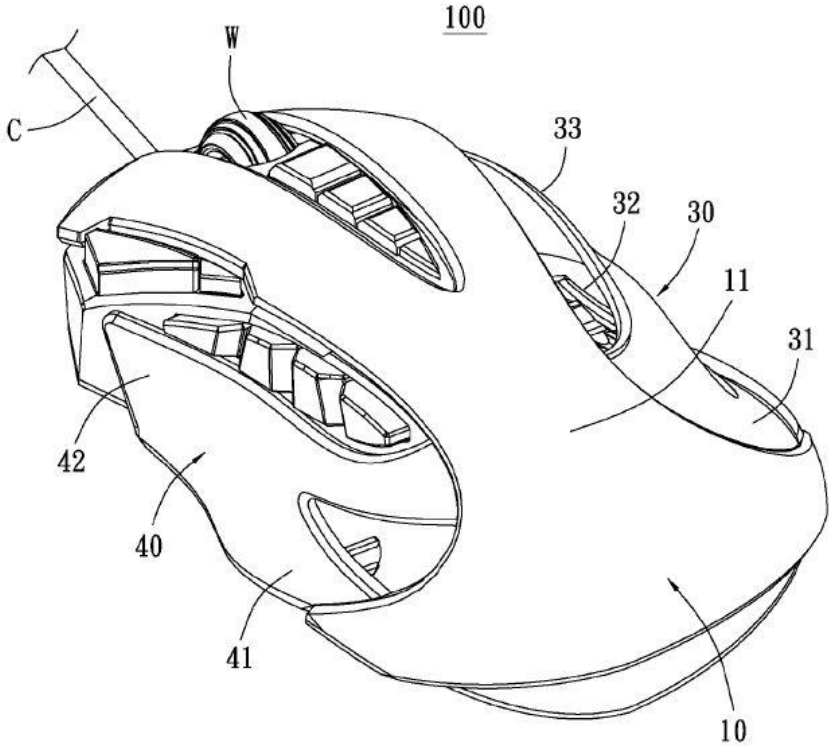

Figure 2. Mouse with decorative wings[2]

1.3.3 Mad Catz R.A.T 7

MAD CATZ company is the pioneer of highly customizable gaming computer mice for games all over the world. R.A.T. 7 holds Guinness world record for being the most adjustable mouse in the world.

The important features of these customizable mice are listed below.

- Support both palm and claw grip.
- The thumb panel of the mice can move forward, backward and pivot upwards, giving perfect position for effortless gaming.
- Interchangeable pinkie grip and palm rest.

3 palm rests

- One featuring same soft touch finish found on the body of the R.A.T
- One with rubber inlay for enhanced grip.
- One that is 4mm thicker to increase the height of the R.A.T.

3 pinkie grips

- One featuring same soft touch finish found on the body of the R.A.T
- One with rubber inlay for enhanced grip.
- One that offers a wing shaped design allowing to rest pinkie finger during play for enhanced grip

Figure 3. Top and bottom view of R.A.T. 7[3]

2. Reverse Engineering of Existing Computer Mice

Two computer mice with large difference in size were chosen for reverse engineering so as to obtain their dimensions which shall serve as upper and lower limits for the operation of the proposed mechanism.

The two mice were:

- Microsoft Intelli 3.0 Alienware Edition (larger in size)
- Steelseries Kinzu

First the point cloud data of the mice were collected using FARO arm laser scanning probe.

FARO arm laser scanning probe is a laser assisted coordinate measuring machine (CMM) which is used to gather point cloud data consistent with the physical structure of an object. The point cloud can then be processed to obtain the CAD model of the respective object

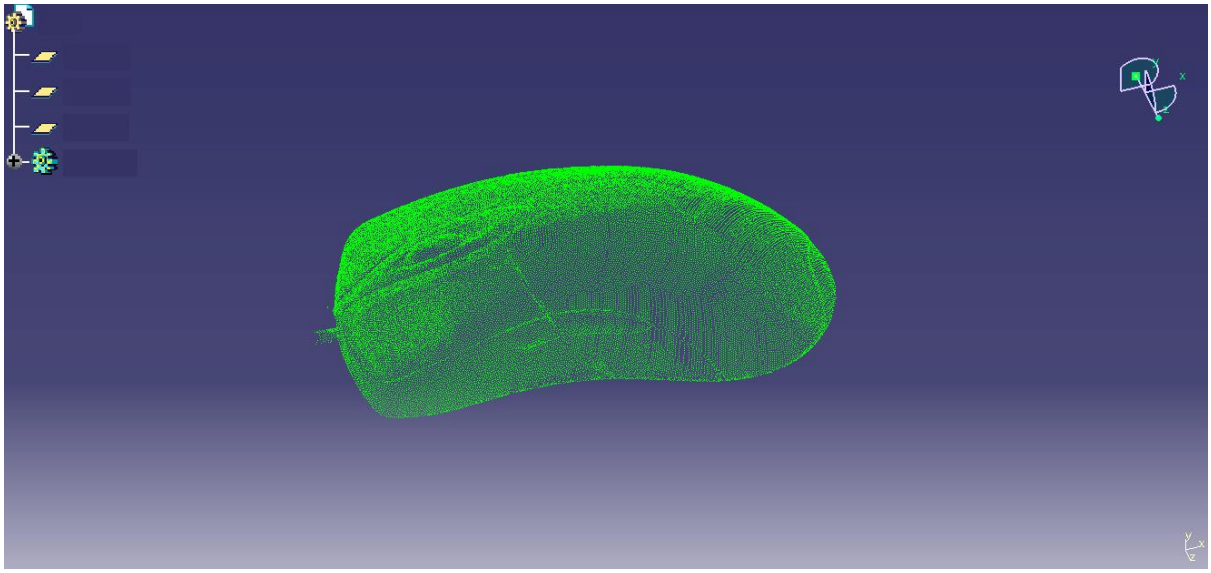

Figure 4. Point cloud data of Intelli

The above point cloud data has undergone trimming, homogenous filtering using CATIA V5 software.

Then mess generation was done in order to get a continuous mess.

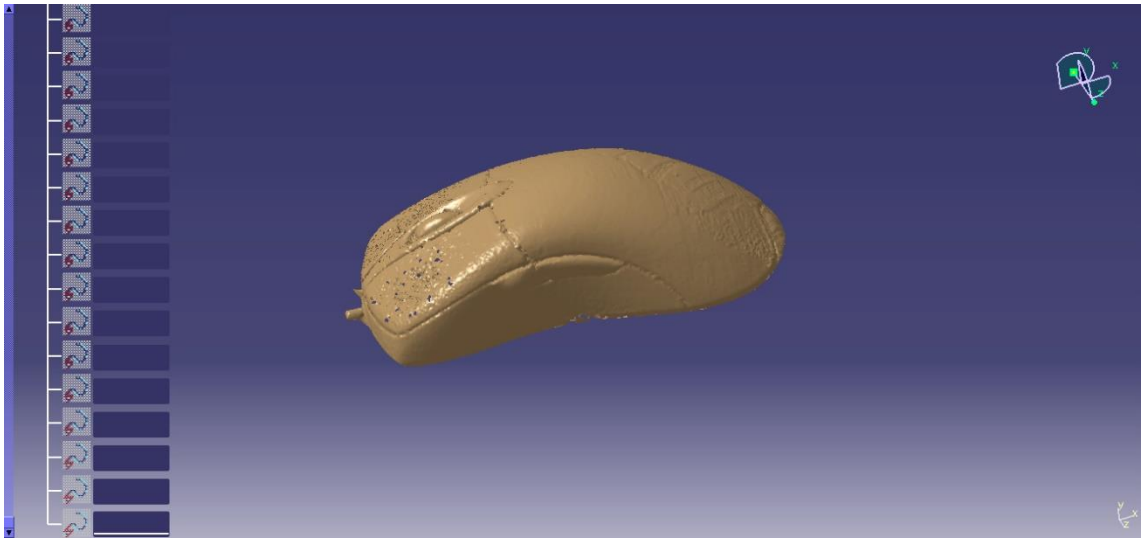

Figure 5. Messed model of Intelli

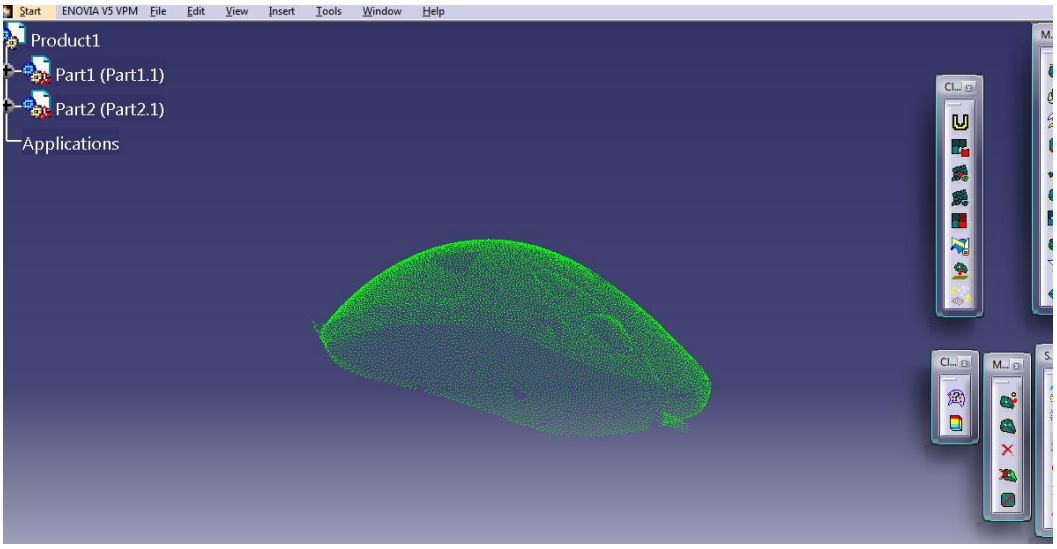

Figure 6. Point cloud data of Kinzu

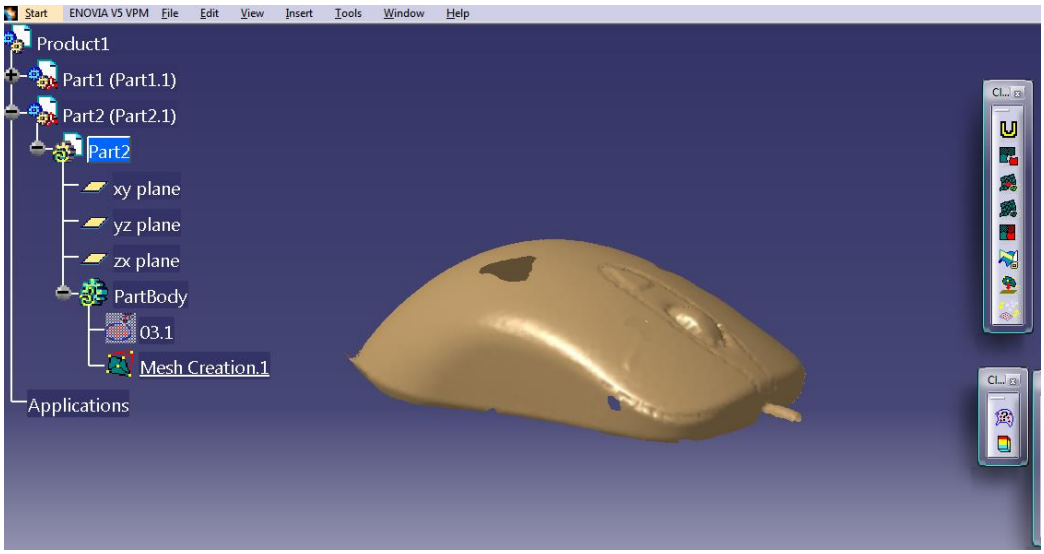

Figure 7. Meshed model of Kinzu

The following measurements were obtained for the Mcrosoft Intelli 3.0 Alienware mouse

- Length: 13 cm
- Height: 3.5 cm
- Width: 6.5 cm (variable width along the length)

Similarly the following measurements were obtained for the Steelseries Kinzu mouse:

- Length: 11 cm
- Height: 2.7 cm
- Width: 5 cm

3. Development of Adjustment Mechanism

The mechanism had to be developed in such a way that all dimensions of the mouse increased and decreased using a single control. After going through many iterations the following mechanism was deemed fit serving the purpose.

In this mechanism two concentric spherical parts were used to act as the combined upper profile of the mouse which will be responsible for elongation of the length and increase of the height of the mouse.

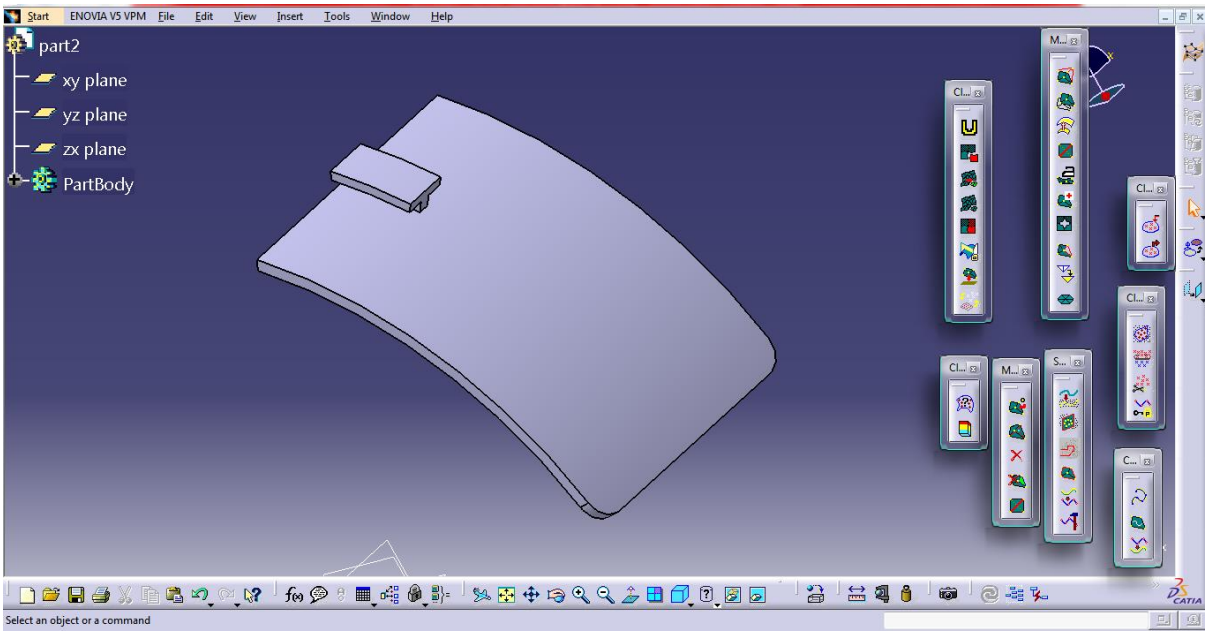

Figure 8. Upper front part

This part contains a projection to couple with the upper rear part.

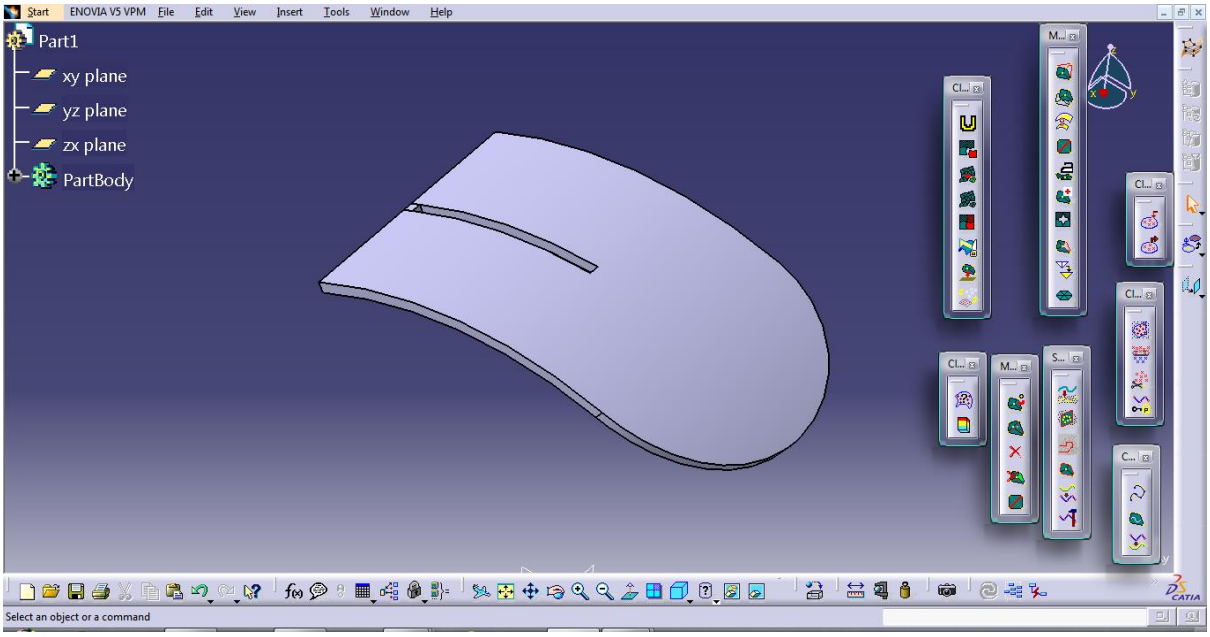

Figure 9. Upper rear part

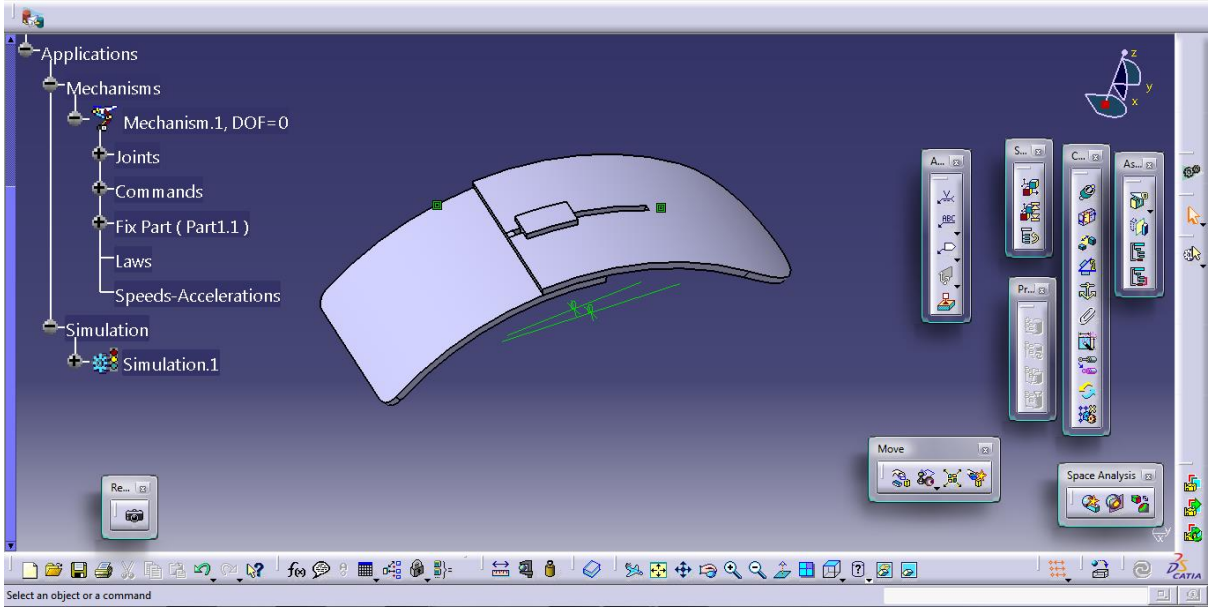

Figure 10. Mechanism consisting of both parts in position 1

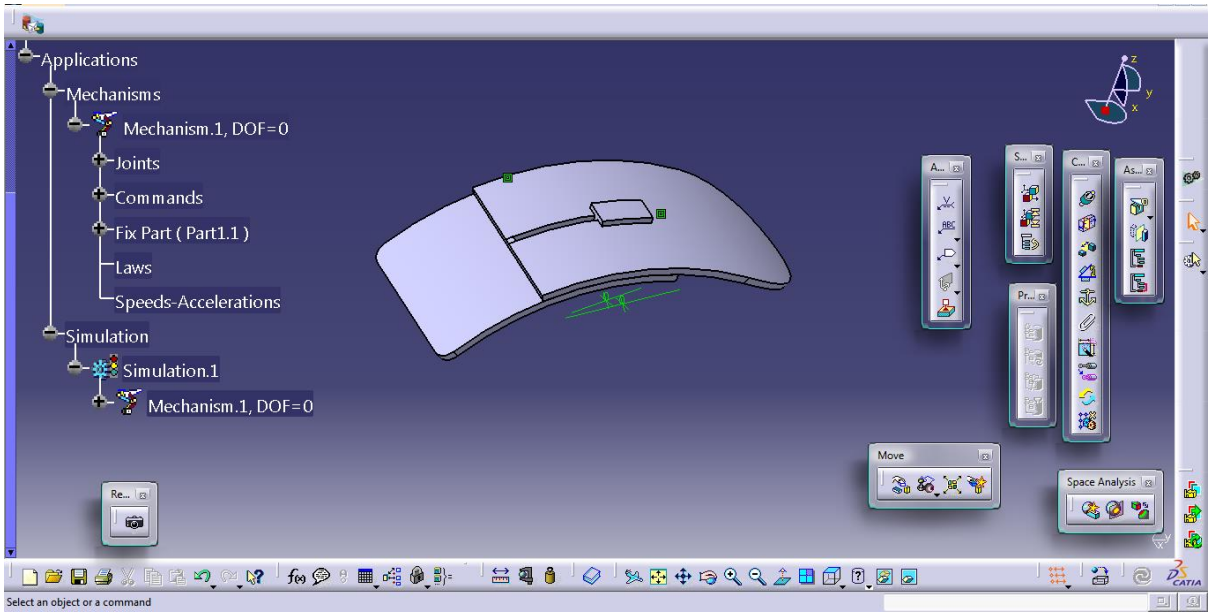

Figure 11. Position 2 of the mechanism

The two positions are separated by an angular displacement of 15 degrees. Thus the height as well as length of the mouse can be simultaneously using this mechanism.

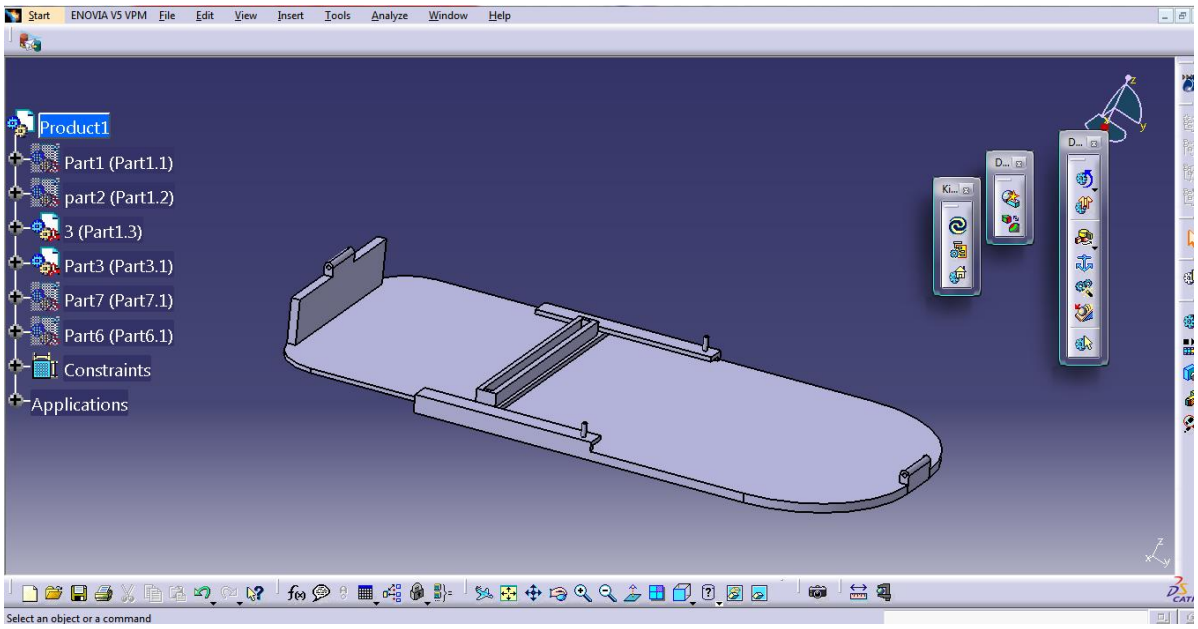

Figure 12. Bottom plates

The two bottom plates are held in place by means of a prismatic joint. The front bottom plate is connected to the front upper plate and the rear bottom plate is connected to the rear upper plate by revolute joints

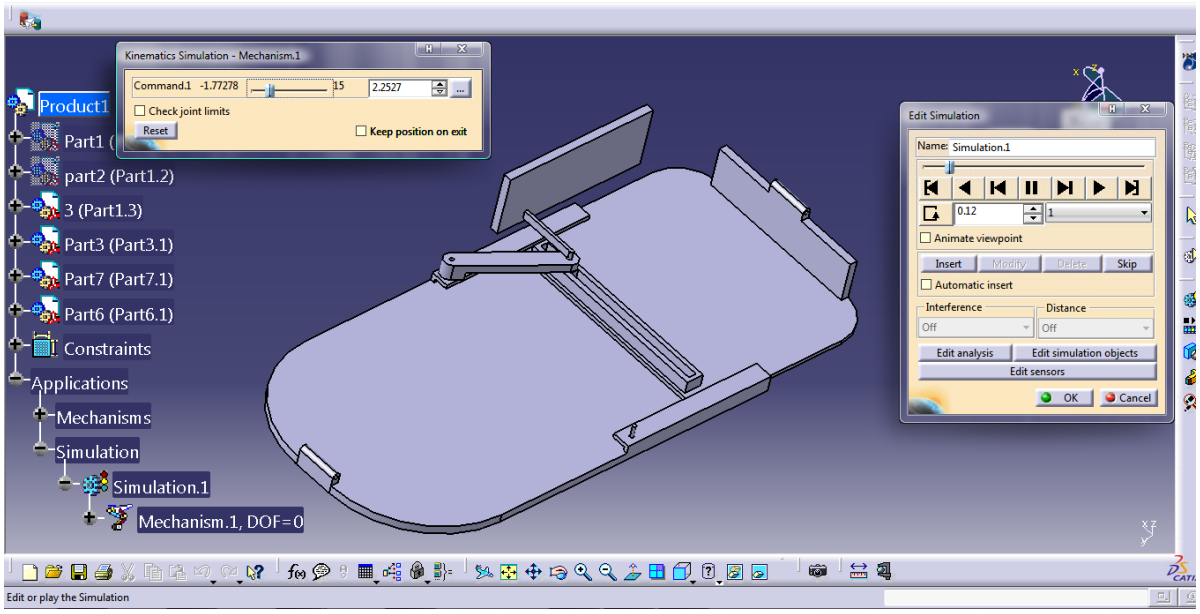

Figure 13. Bottom Assembly

The bottom assembly consists of two connecting rods as shown in figure 13. As there is relative slinding motion between the two bottom plates, the connected rod attached to the rear plate moves outwards following an angular motion. This helps in sideways motion of the thumb rest along a linear groove which is present in the bottom front plate.

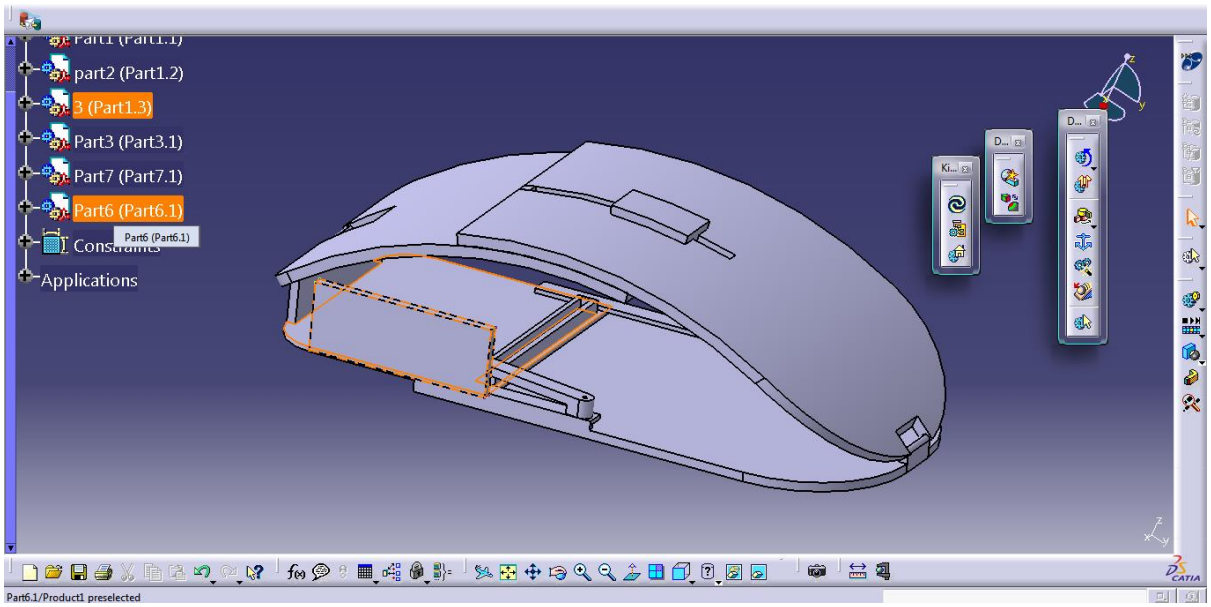

Figure 14. Final structure

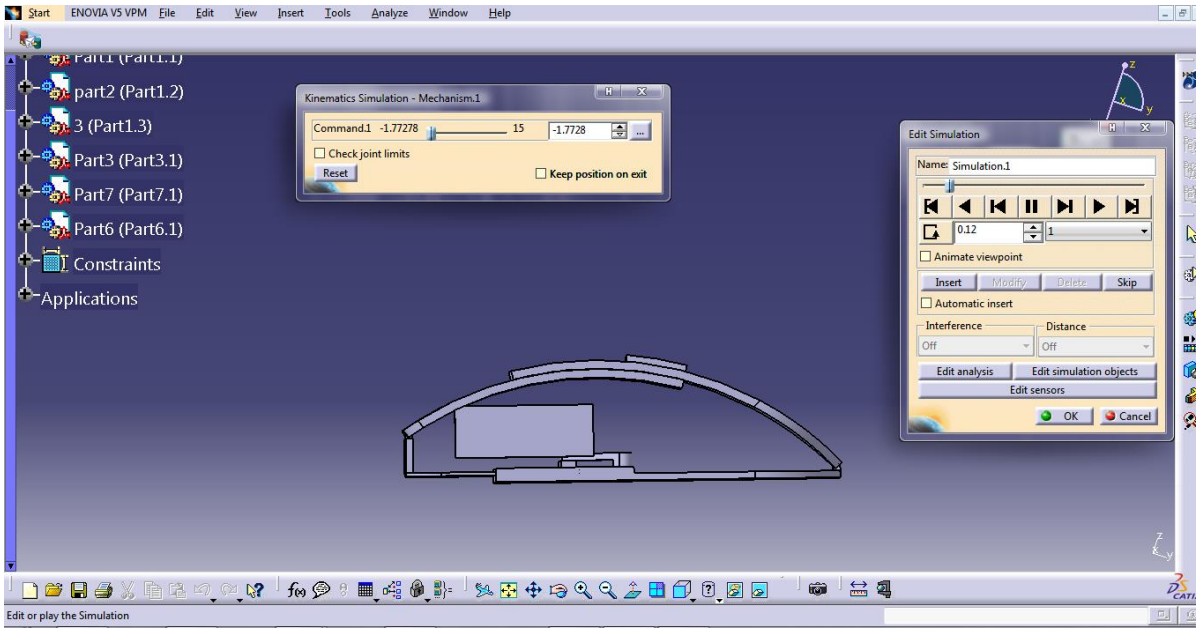

Figure 15. Side view in contracted form

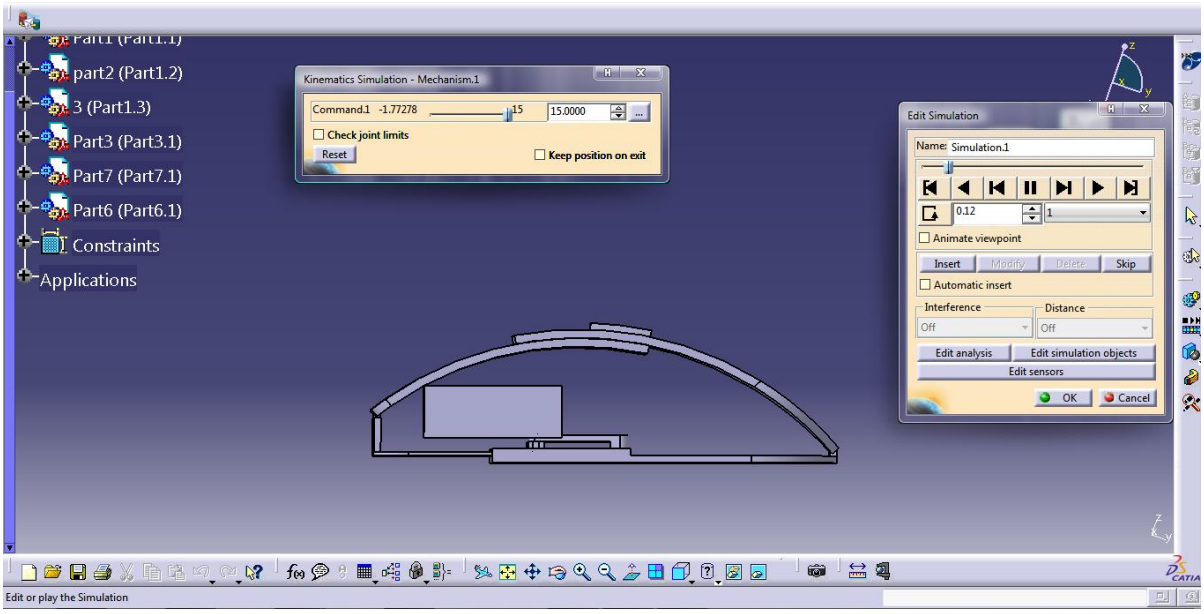

Figure 16. Side view in expanded form

Comparison between the two side views in Fig 15 and 16 shows that there is simultaneous increase in length and height of the mouse. Similarly comparison between the top views in Fig 17 and 18 shows that there is simultaneous increase in length and breadth. As the whole mechanism is fully constrained, no part can move independent of the other part. Therefore only one control input can is enough for changing all dimension of the mouse simultaneously.

Furthermore, a locking mechanism could be devised for locking the mouse in a particular configuration. The locking mechanism could be implement on any component of the mouse as all components are constrained.

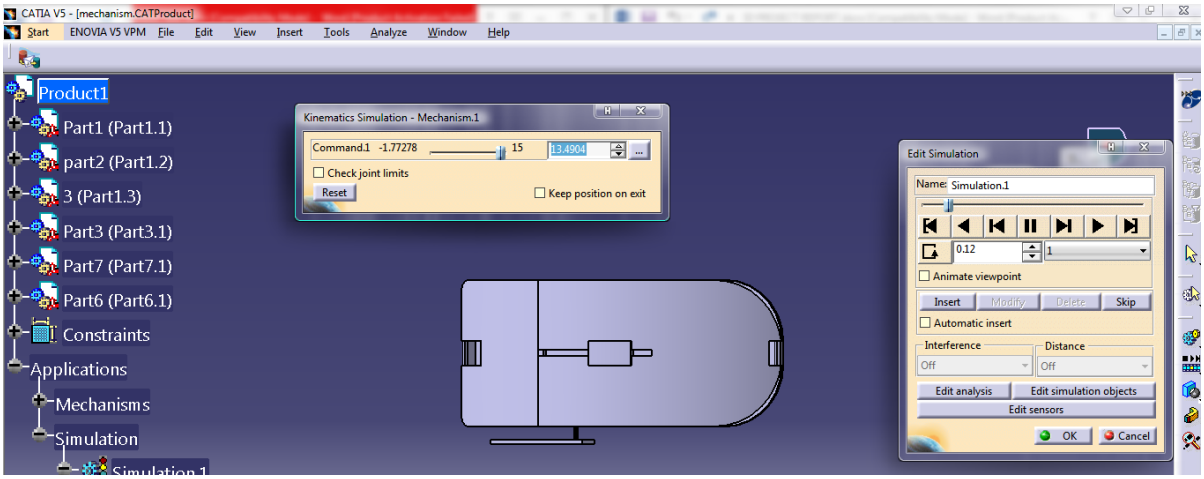

Figure 17. Top view in expanded form

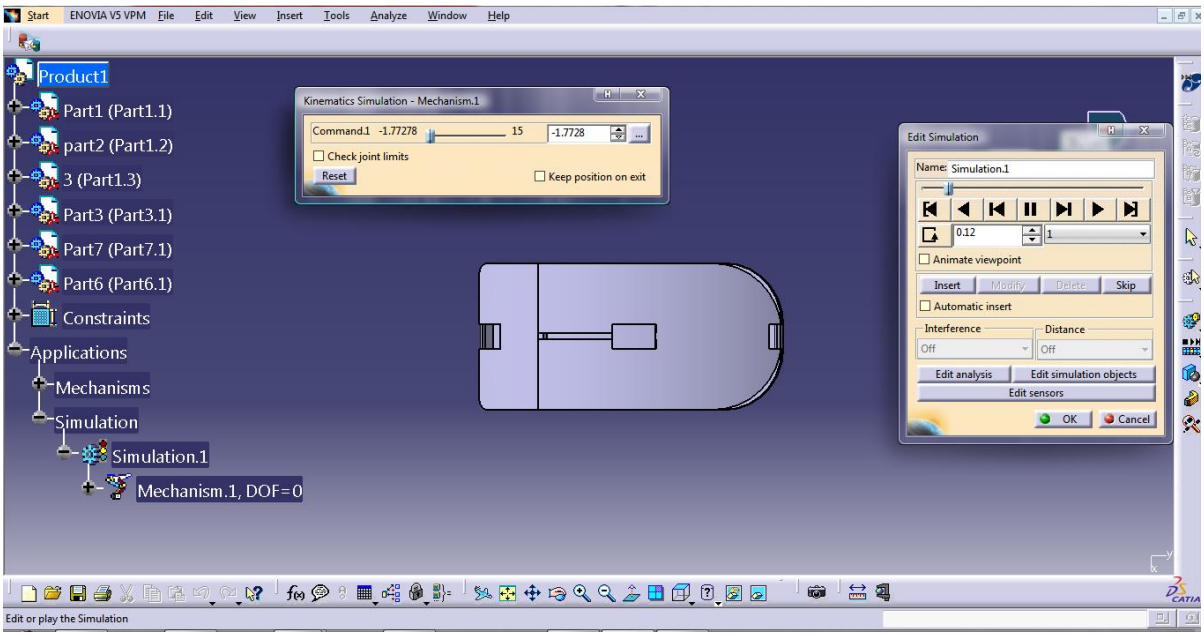

Figure 18. Top view in contracted form

4. Prototype Development

A prototype shall be built using Rapid Prototyping technology. All the components of the prototype shall be made of ABS plastic.

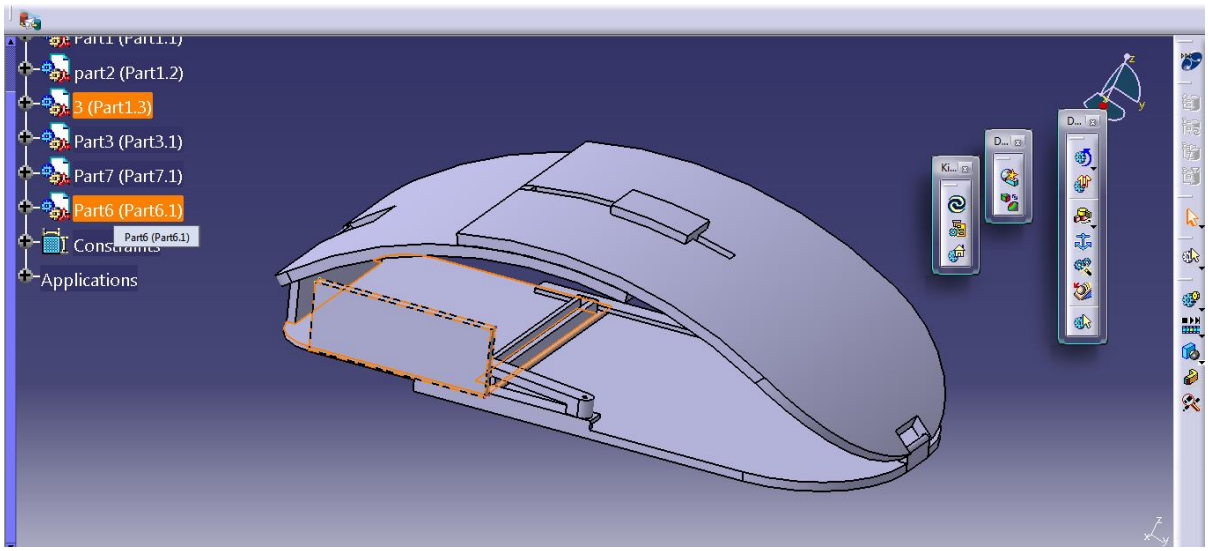

Figure 19: CAD model for prototype development

5. Conclusions and Future Scope

6.1 Conclusions

The mechanism which has been designed is capable of changing the dimensions of the mouse from 11 cm to 14 cm length-wise, 2.5cm to 4 cm height-wise and 6cm – 8cm width wise. More tweaks can be made to the dimensions of the interior parts so as to change the readings mentioned above. Hence the mechanism has been successful in changing the length breadth and height of the mouse simultaneously using a single control input.

6.2 Future Scope

The design can be further improved by studying the hand anthropometry of people of various age groups and both genders so as to calibrate the mechanism for providing better comfort. More electronic functions could also be introduced such as

Adjustable Clicking Force Function [4]

This involves explicitly or implicitly changing the amount of force to be exerted a finger to perform a successful click of the mouse button. The solution of this problem has been attempted by many people but its popularity has been fairly low.

Electronic/Mechanical Profile Storage System

As the mouse shall have extensive customizability of physical dimensions, it shall be an irritating for a user to adjust the mouse again and again based on the needs.

Example:

- If a single user is using a mouse, he/she may have to switch between 2-3 configurations for various tasks like – relaxed browsing, photoshoping, intense gaming etc. So in order to prevent the user from undergoing the process of process of adjusting the mouse each time before a particular type of task, a proper calibration or memory system might help.
- Similarly if the mouse is used by 2-3 people in a household, then it might occur that some member of the house has changed the configuration of the mouse just before u have to use it. So you will have to reset the mouse each time before you have to work with it. This may lead to frustration and you may want to use the mouse as it is.

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[1] Kimura K.:2009. ”Angle Adjustable computer mouse that can be used with either hand”; Pub. No.: US 2009/0295726 A1

[2] Wang T.S.:2013. “Computer mouse with adjustable decorative wing” Pub. No.: US 2014/0210718 A1

[3] http://store.madcatz.com/categories/mice-category/Mad-Catz-RAT-7-Gaming-Mouse-for-PC-and-Mac.html

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